GCADA 21st Annual Summit

Teenage Addiction: A Pain in the Brain

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September 15, 2012

Hyatt Regency

New Brunswick

Objectives

- Review Prevention Programs in the School
- Understand adolescents and brain function
- Overview of addiction and adolescents
- Explain why treatment doesn’t always work the first time around
- Explore myths of addiction and the biological origins

Guidance Vs Counselor

- The counseling profession entered the schoolhouse in the early 20th century

Jesse B. Davis - introduced “vocational and moral guidance” as a curriculum into an English course

This was the first systematic guidance program in public schools

Safe and Drug Free School

- 1986 Federal Government Determines that substance use is an hindrance to academic achievement.
- Schools need to develop programs to ensure student academic success

New Jersey Responds

- NJS 18A:40A
- Establish comprehensive alcohol, tobacco and other drug abuse programs.
- Adoption of policies and procedures for the intervention of student substance abuse
- Reporting, notification and examination procedures for students suspected of substance abuse.

18A:40A Continued

- Any staff member that suspects a student is under the influence report the matter the incident and student must be evaluated by a medical professional
- Staff to receive inservice
- Establishes the position of Substance Awareness Coordinator

Confidentiality 6A:16-3.2

- Confidentiality of student alcohol and other drug information.
- Counseling services are confidential in matters of substance abuse.
- Adolescents have a right to counseling services when parents are is dependant onsubstances
- Require a court order to gain access to records

Student Assistance Programs: Responding to the emotional needs of Adolescents

ADOLESCENT BRAIN DEVELOPMENT

Barbara Sullivan, Ph.D.
Utah Addiction Center

CAVEATS

- New discoveries—research is still in its infancy
- Do **NOT** over-interpret or interpret too simplistically
- Most research has been conducted on animals—we assume the information transfers to people
- Behavior is the result of complex interactions among individual, environment, genetics, situation, cultural expectations, and numerous other factors

BRAIN FACTS

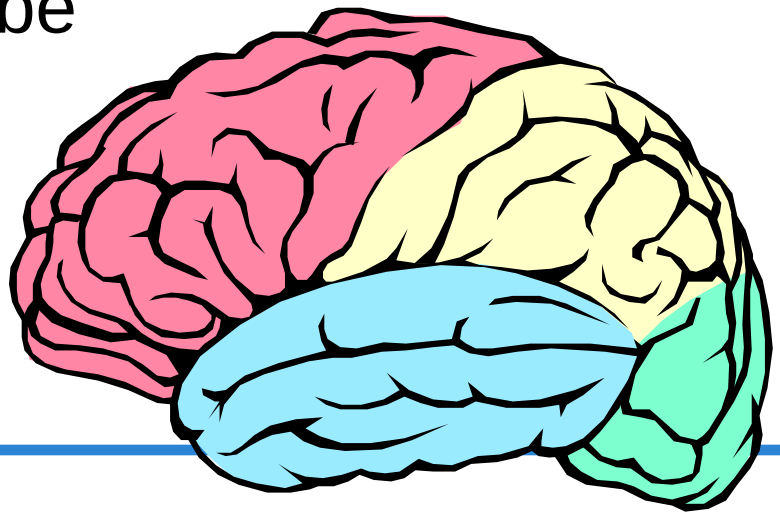
- Brain weighs approximately 3 pounds
- Brain has approximately 100 billion neurons and 1 trillion supporting cells
- Neurons grow and organize themselves into efficient systems that operate a lifetime

- Brain controls ALL activities
- Emotion and cognition are intertwined
- Neurons can re-route circuits
- Brain and environment involved in delicate duet
- Brain never stops adapting and changing

BRAIN STRUCTURES AND FUNCTIONS

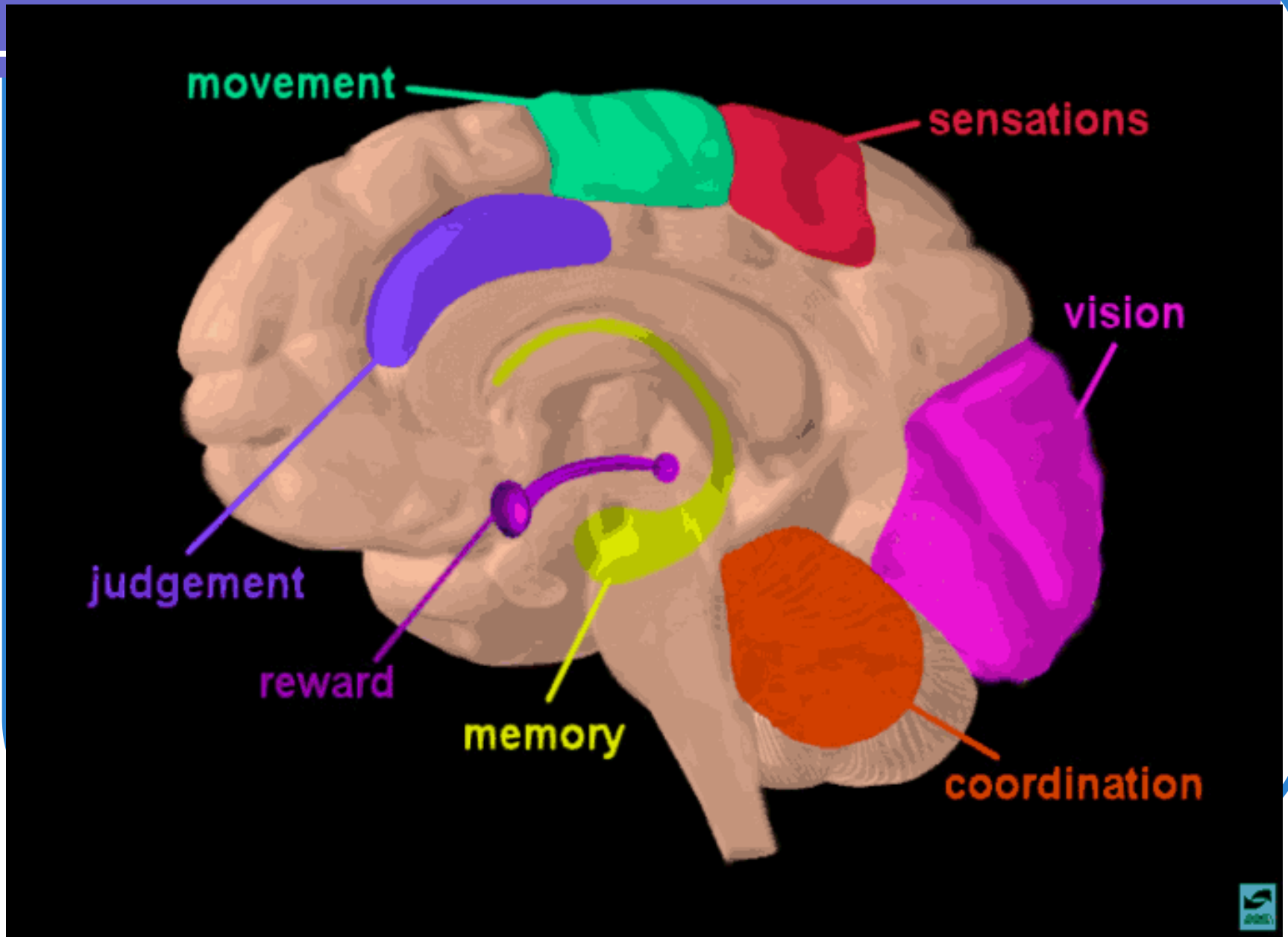
BRAIN STRUCTURES

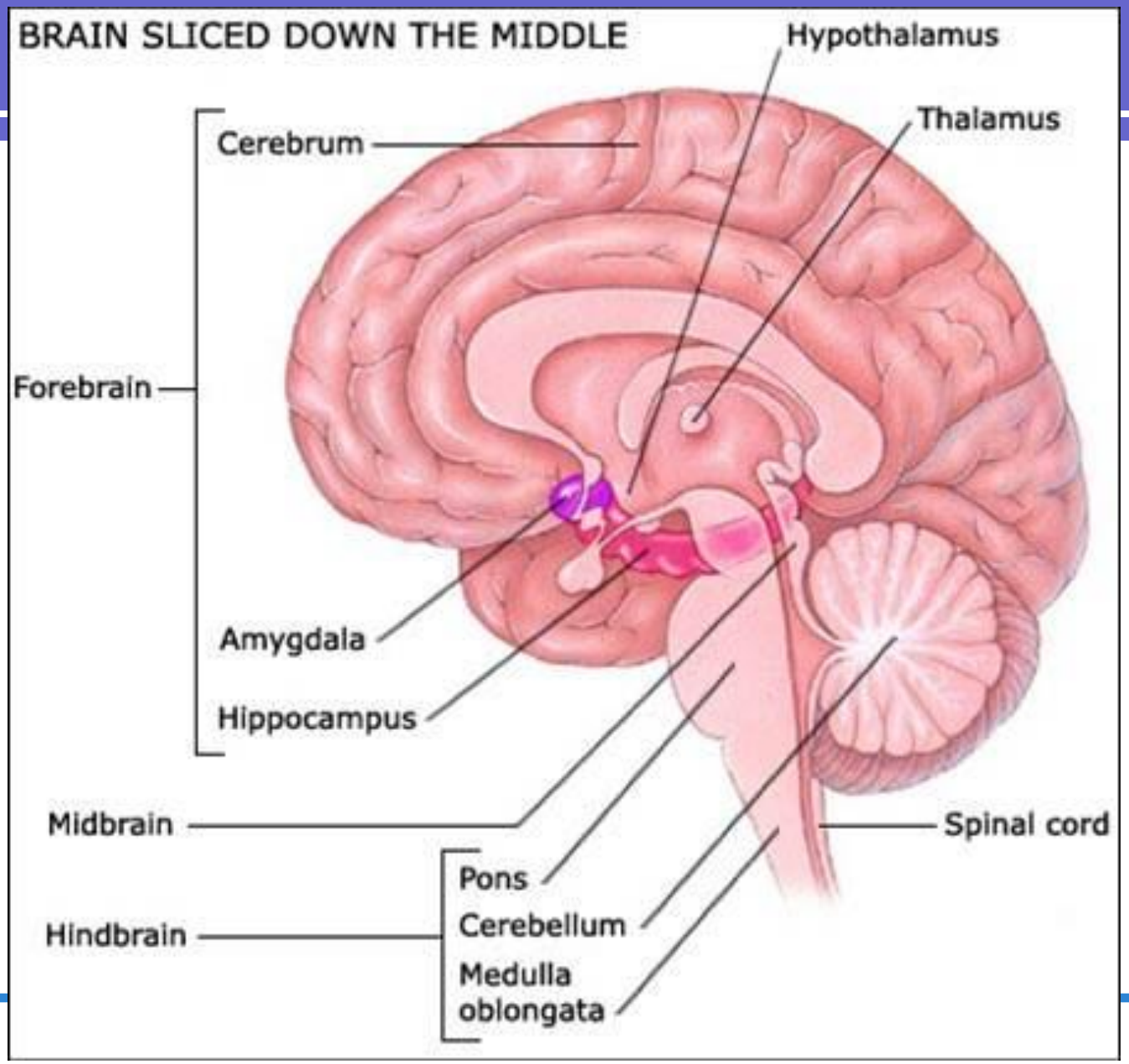
- Frontal Lobe
- Parietal Lobe
- Temporal Lobe
- Occipital Lobe
- Cerebellum
- Corpus Callosum
- Brain Stem



BRAIN STRUCTURES

- Brain is an organ of behavior—both overt behavior and consciousness are manifestations of the work of the brain
- Different regions of the brain regulate different functions. Our thoughts, behaviors, and emotions are the result of how the different parts of the brain work together to process information and memories


movement
sensations
vision
judgement
reward
memory
coordination

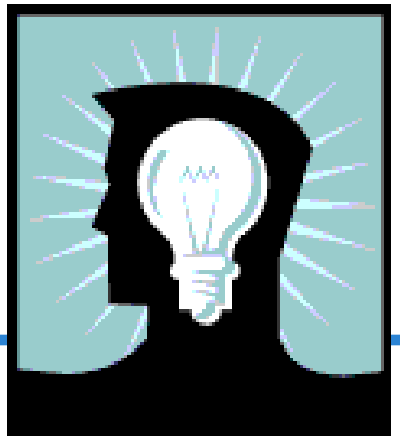

BRAIN SLICED DOWN THE MIDDLE
Hypothalamus
Thalamus
Cerebrum
Forebrain
Amygdala
Hippocampus
Midbrain
Spinal cord
Pons
Hindbrain
Cerebellum
Medulla
oblongata

FRONTAL LOBE

- Seat of personality, judgment, reasoning, problem solving, and rational decision making
- Provides for logic and understanding of consequences
- Governs impulsivity, aggression, ability to organize thoughts, and plan for the future
- Controls capacity for abstraction, attention, cognitive flexibility, and goal persistence
- Undergoes significant changes during adolescence — *not fully developed until mid 20's*

FRONTAL LOBE

- As the “prefrontal cortex” area of the frontal lobe matures, through experience and practice, teens can reason better, develop more impulse control, and make better judgments
- Prefrontal cortex is one of the last areas of the brain to fully develop
- Increased need for structure, mentoring, guidance



TEMPORAL LOBES

- Responsible for hearing, understanding speech, and forming an integrated sense of self
- Responsible for sorting new information and for short term memory
- Contains the limbic-reward system (amygdala, hippocampus, nucleus acumbens, and vta)
- Matures around ages 18-19

TEMPORAL LOBE/LIMBIC SYSTEM

- Limbic system regulates emotions and motivations—particularly those related to survival—such as fear, anger, and pleasure (sex and eating)
- Feelings of pleasure/reward are very powerful and self-sustaining. Pleasurable behaviors activate a circuit of specialized nerve cells in the limbic area that is devoted to producing and regulating pleasure called the reward system

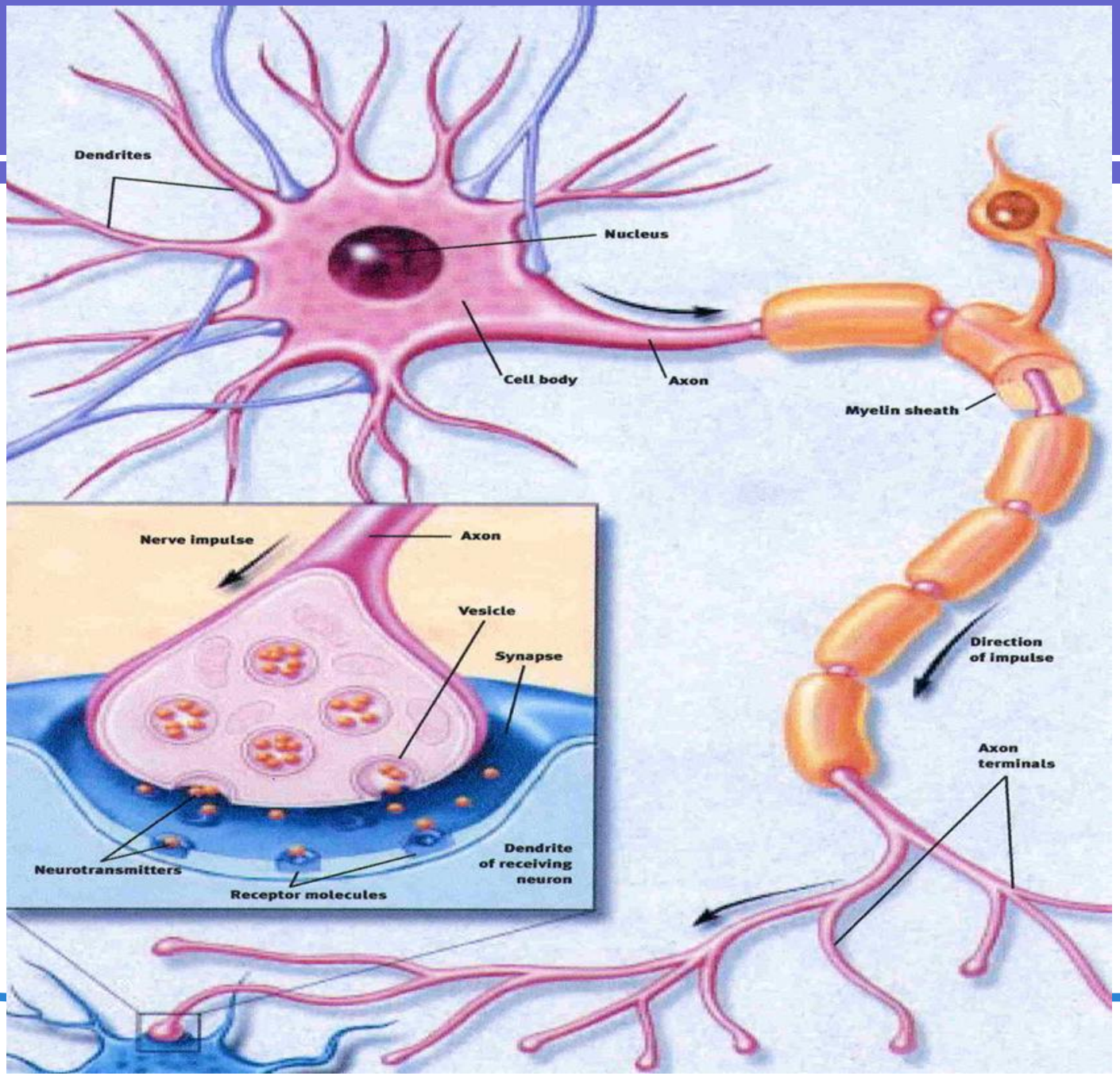
REWARD SYSTEM

- Drugs of abuse activate the reward system in the limbic area of the brain—producing powerful feelings of pleasure
- Desire to repeat drug using behavior is strong
- Drugs of abuse can/do exert powerful control over behavior because they act directly on the more primitive, survival limbic structures—over-ride the frontal cortex in controlling our behavior

BRAIN CIRCUITRY

Brain Circuitry

- ***NEURON —specialized cell designed to transmit information to other nerve cells and muscles***
- ***Each neuron consists of a cell body, axon, and dendrite***
- ***Axon– an electricity conducting fiber that carries information away from the cell body***
- ***Dendrite– receives messages from other neurons***
- ***Synapse– contact point where one neuron "communicates" with another neuron***

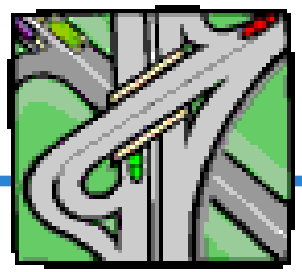

Dendrites
Nucleus
Cell body
Axon
Myelin sheath
Direction of impulse
Axon terminals
Nerve impulse
Axon
Vesicle
Synapse
Neurotransmitters
Receptor molecules
Dendrite of receiving neuron

BRAIN CIRCUITRY

- Neurons “communicate” by transmitting electrical impulses along their axons
- Axons send messages across a synapse to the receiving dendrite of the target neuron
- Each neuron has an average of 6,000 dendrite receptors
- Dendrite receptor sites are specialized areas— “lock and key”

BRAIN CIRCUITRY

- A neuron may receive many different messages at the same time (Prioritize)
- Each neuron has to “interpret” incoming messages
- Neuronal communication is currently under intense study because it plays such a critical role in health and well being



BRAIN CIRCUITRY

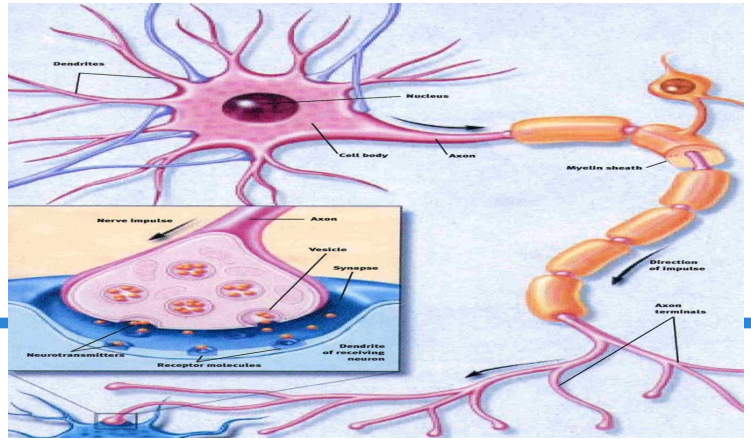
- *Gray matter contains neurons that are responsible for “thinking” (100 billion)*
- *White matter contains suportive cells with nutritive roles (dendrites—1 trillion)*
- *Myelin is a layer of insulation that progressively insulates these supportive cells and is whitish in color*
- *Myelin makes white matter more efficient—just like insulation on electric wires—contributes to overall cognitive functioning*

BRAIN CIRCUITRY

- Example—It is the gray matter that recognizes the soccer ball coming towards you; it is the white matter that orders the movement of your leg to kick the ball
- Myelin allows for more efficient communication between the white and the gray matter—myelination continues until early 30's

NEUROTRANSMITTERS

- All messages all passed to connected neurons through the form of chemicals called neurotransmitters
- Neurotransmitters are released from the end of the axon, cross the synapse, and bind to the specific receptors on the dendrites of the targeted neuron



MAJOR NEUROTRANSMITTERS

- Acetylcholine—regulates memory
- Dopamine—produces pleasure through the "reward system"; multiple functions including controlling movement, regulates hormonal responses, important to cognition and emotion; abnormalities in dopamine levels have been implicated in schizophrenia
- Serotonin—Plays a role in sleep; involved in sensory perception; and involved in controlling emotional states such as anxiety and depression

MAJOR NEUROTRANSMITTERS

- Glutatmate — excites the firing of neurons, aids process of memory

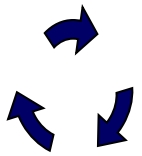
Gamma-aminobutyric (GABA) — inhibits the firing of neurons

OVERPRODUCTION AND PRUNING

CRITICAL PEAKS OF BRAIN DEVELOPMENT

OVERPRODUCTION AND PRUNING

- Brain development occurs in 2 basic stages– growth spurts/overproduction of neurons and pruning
- Critical phases: in utero
  0-3 years
  10-13 years



overproduction

Overproduction results in significant increase in the number of neurons and synapses

Exuberant growth during these 3 phases gives the brain enormous potential

PRUNING

- These 3 critical phases are quickly followed by a process in which the brain *prunes and organizes* its neural pathways
- ***LEARNING*** is a process of creating and strengthening frequently used synapses (brain discards unused synapses)
- Brain keeps only the most efficient and "strong" synapses
- Children/teens need to understand that they decide which synapses flourish and which are pruned away

PRUNING

- **"USE IT OR LOSE IT"–** Reading, sports, music, video games, x-box, hanging out—whatever a child/teen is doing—these are the neural synapses that will be retained
- How children/teens spend their time is **CRUCIAL** to brain development since their activities guide the structure of brain



DEFINING ADOLESCENCE

ADOLESCENCE

- Awkward period between sexual maturational and the attainment of adult roles and responsibilities
- ***Begins*** with the domain of physical/biological changes related to puberty, but it ***ends*** in the domain of social roles
- Encompasses the transition from the status of a child (one who requires monitoring) to that of an adult (responsible for behavior)

ADOLESCENCE

- Adolescence is much broader and longer than the teenage years alone (***has changed significantly over the past 150 years***)
- Adolescence now stretches across more than a decade, with pubertal onset often beginning by age 9-12 and adult roles delayed until mid twenties (Worthman, 1995))
- In 187 societies, the interval between puberty and achieving adult status was typically 2 years for girls and 4 years for boys (Schlegel and Barry, 1991)

ADOLESCENCE

- Most elements of cognitive development show a trajectory that follows age and experience rather than the timing of puberty
- Research conducted by Martin, 2003, demonstrates a significant positive correlation between pubertal maturation and sensation seeking

ADOLESCENCE

PUBERTY	AGE/EXPERIENCE
Romantic motivation	Planning
Sexual interest	Logic, reasoning
Emotional intensity	Inhibitory control
Sleep cycle changes	Problem solving
Appetite	Understanding consequences
Risk for affective disorders (girls)	Affect regulation
Increase in risk taking, sensation seeking, and novelty seeking	Goal setting and pursuit
	Judgment and abstract thinking

IMPACT OF ALCOHOL ON ADOLESCENT BRAIN DEVELOPMENT

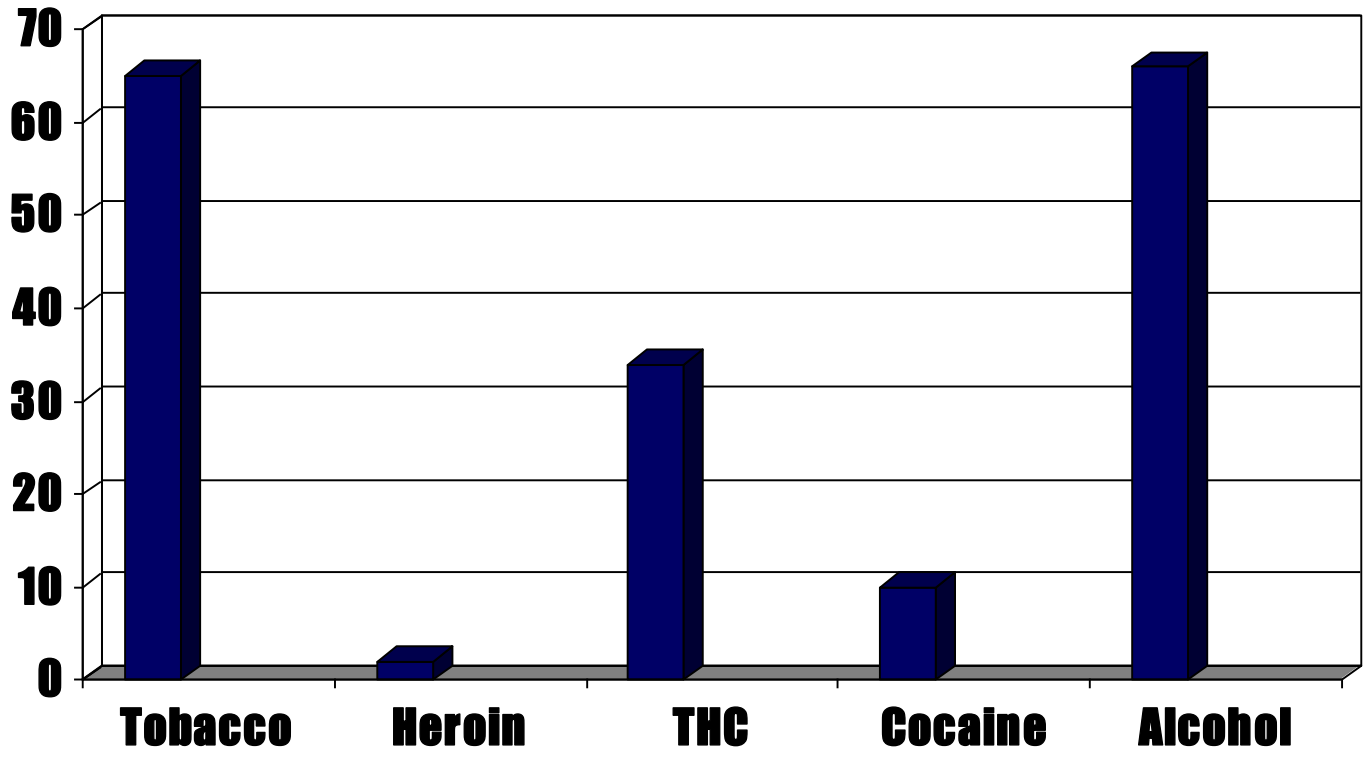
ARE ADOLESCENTS MORE SUSCEPTIBLE TO ALCOHOL THAN ADULTS?

- Adolescent rats are **LESS** sensitive to the sedative and motor impairment effects of alcohol.
- Adolescent rats are **MORE** sensitive to the social disinhibition induced by alcohol use

ARE ADOLESCENTS MORE SUSCEPTIBLE THAN ADULTS TO ALCOHOL?

- Adolescents appear to be **MORE** sensitive to the learning and memory impairment effects of alcohol
- Adolescent drunk rats perform **worse** on memory tasks than adult drunk rats
  - Disruption of the Hippocampus
  - Brain damage in the PFC

Percentage of U.S. Population (Aged 12 and Over)
Who have ever Used Drugs of Abuse



ALCOHOL'S EFFECTS

- Adolescents with a history of extensive alcohol use, compared to a control group…
  - Reduced Hippocampus volume (10-35%)
  - Less brain activity during memory tasks

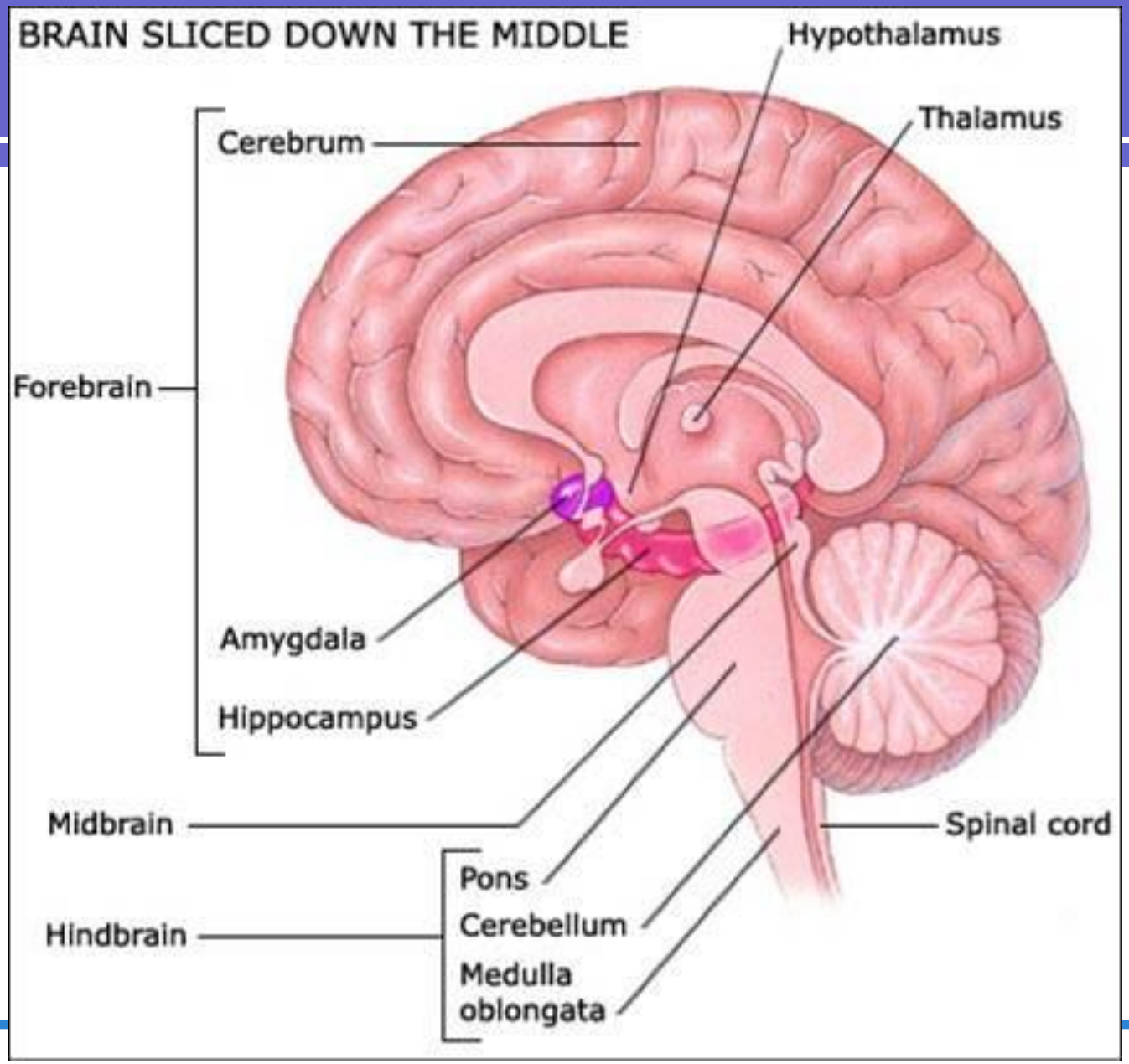
Critical Differences Between Adult and Adolescent Thinking

DISPARITIES OF ADOLESCENCE

- Adolescence is a TRANSITIONAL period during which a child is becoming, but is not yet, an adult
- Adolescent brains are far less developed than we previously believed
- Normal adolescent development includes conflict, facing insecurities, creating an identity, mood swings, self-absorption, etc.

ADOLESCENT BRAIN DEVELOPMENT

- Underdevelopment of the frontal lobe/prefrontal cortex and the limbic system make adolescents more prone to "behave emotionally or with 'gut' reactions"
- Adolescents tend to use an alternative part of the brain– the AMYGDALA (emotions) rather than the prefrontal cortex (reasoning) to process information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ADOLESCENT BRAIN DEVELOPMENT

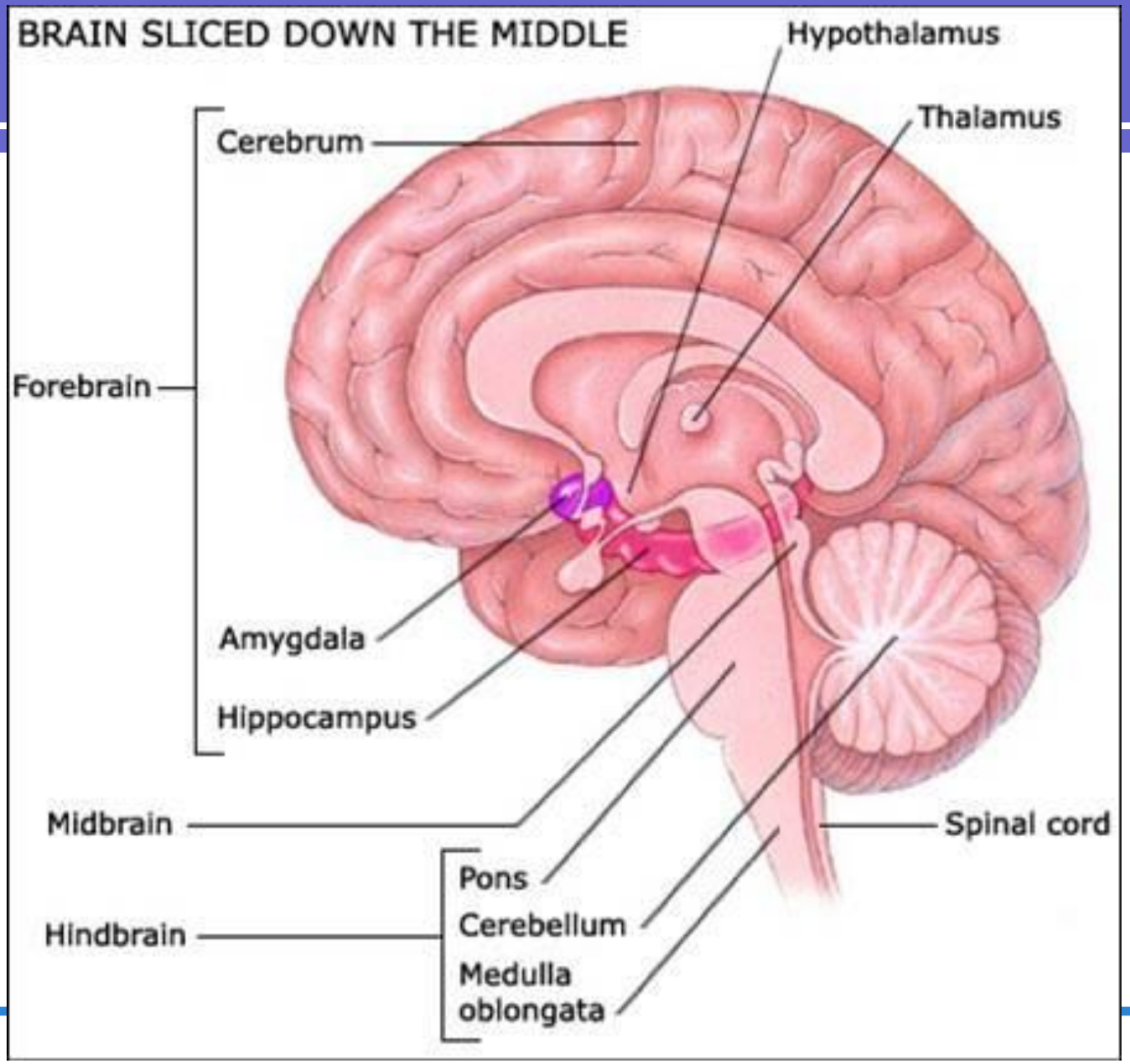
- Amygdala and nucleus acumbens (limbic system within the prefrontal cortex) tend to dominate the prefrontal cortex functions– this results in a decrease in reasoned thinking and an increase in impulsiveness
- Because of immature brains, adolescents do not handle social pressure, instinctual urges, and other stresses the way adults do
- A major part of adolescence is learning how to assess risk and consequences — adolescents are not yet skilled at these tasks

HOT AND COLD COGNITION

- Thoughts and emotions are intertwined – teens need to develop a balance between cognitive and affective systems of the brain
- “COLD” cognition refers to thinking under conditions of low emotions and/or arousal
- “HOT” cognition refers to thinking under conditions of strong feelings or arousal
- Decisions made under conditions of strong affect are difficult to influence by cool rational thought alone

HOT AND COLD COGNITION

- Decision making in teens cannot be fully understood without considering the role of *emotions* and the interaction between *thinking and feeling*
- Teen decisions are unlikely to emerge from a logical evaluation of the risk/benefits of a situation – rather decisions are the result of a complex set of competing feelings – desire to look cool, fear of being rejected, anxiety about being caught, excitement of risk, etc.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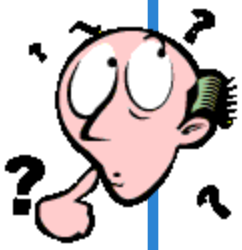
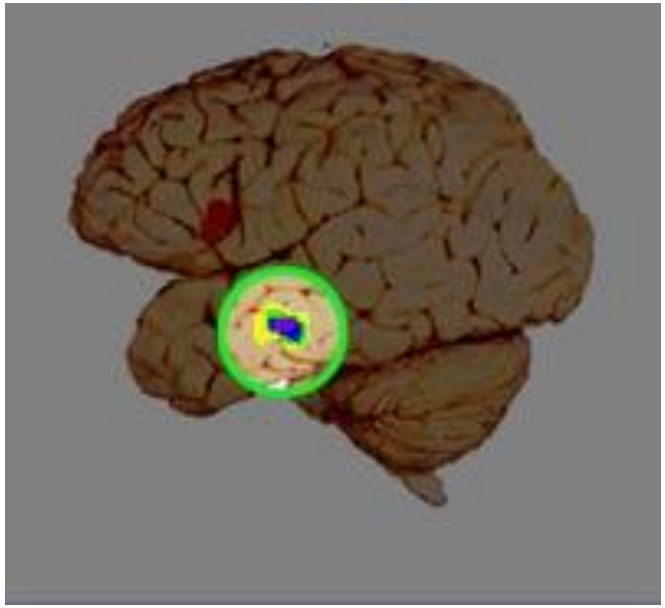
ADOLESCENT BRAIN DEVELOPMENT

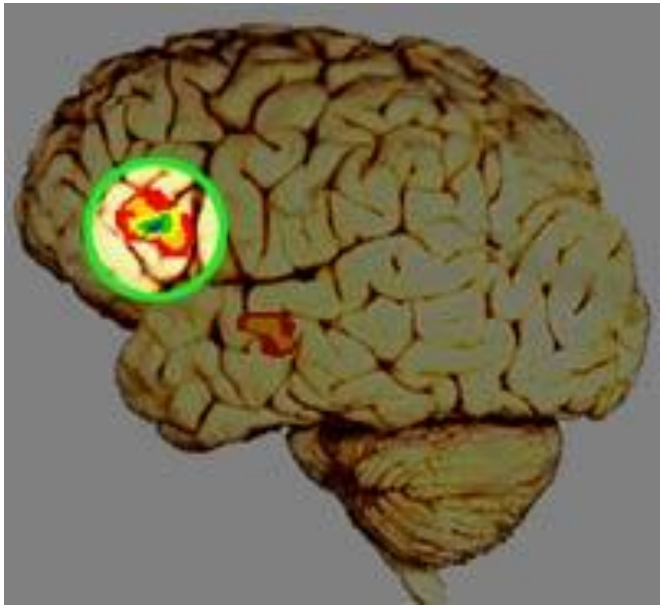
- Adolescents are not very skilled at distinguishing the subtlety of facial expression (excitement, anger, fear, sadness, etc.)—results in a lot of miscues—leads to lack of communication and inappropriate behavior
- Differences in processing, organization, and responding to information/events leads to misperceptions and misunderstanding verbal and non-verbal cues



Adolescent Brain



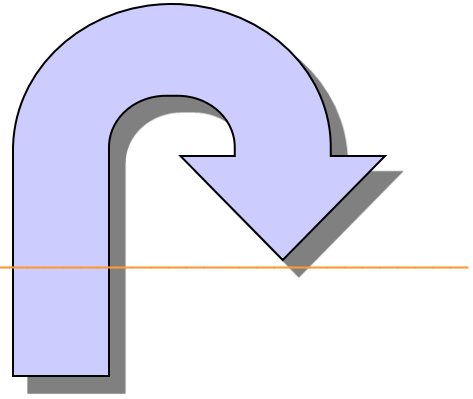
Adult Brain



IMPACT OF ABUSE ON BRAIN DEVELOPMENT AND FUNCTION

Experimentation

High



Baseline behavior

Infrequent use

Return to baseline behavior

Enjoy use-what feels good must be good

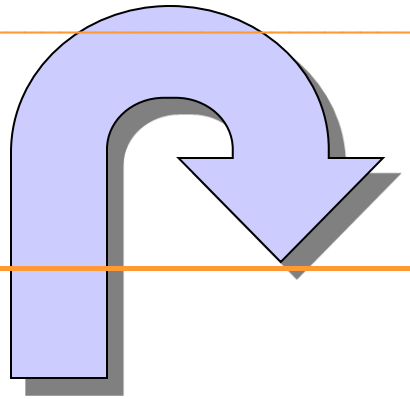
Little tolerance + return to baseline

Normal mood

Regular Use-Seeking the mood
High

Baseline behavior

Pain



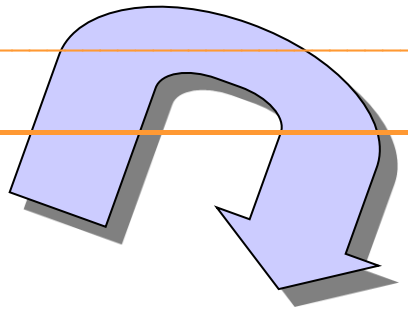
Adds hard liquor
Binge drinking
Use during the week
Increased tolerance
Consequences-hangovers-skip school
Drop non drug using friends
Lying, more money
Mood changes

Daily Preoccupation-preoccupied with the mood swing

High

Baseline behavior

Pain

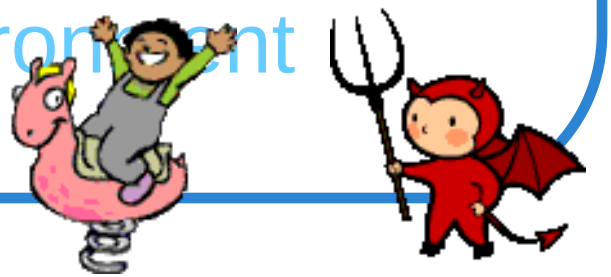


More dangerous drugs
Drugs becomes central focus
Legal problems
Mood changes/withdrawal
Unable to quit on own


Preoccupation
Anticipation
Persistent desire
Larger amounts taken
than expected
Binge
Intoxication
Tolerance
Withdrawal
Compromised social, occupational
or recreational activities
Withdrawal
Negative Affect
Preoccupation with obtaining
Persistent physical/
psychological problems
ADDICTION

SCARS THAT WON'T HEAL

- Growing evidence of altered brain development and functioning as the result of abuse and neglect
- Our interactions with the world "organize our brain's development" and shapes the person we become (Shore, 1997)
- Brain will develop to respond to a positive or a negative environment



SCARS THAT WON'T HEAL

- Chronic stress, abuse, and neglect sensitize certain neural pathways and over-develop certain regions of the brain (limbic region) involved in anxiety and fear. This often results in the under-development of other regions of the brain (frontal lobe)
- Chronic stress from fear, violence, abuse, hunger, pain, etc. focuses the brain's resources on ***survival*** and other areas of the brain are not "available" for learning social and cognitive skills

BRAIN'S RESPONSE TO THREAT

- Brain is uniquely designed to mobilize the body in response to threat—all body response—fight or flight
- Neurochemical systems cause a cascade of changes in attention, impulse control, sleep patterns, and fine motor control
- Chronic activation of the neural pathways involved in fear creates "memories" which shape a person's perception of and response to the environment—indelible perception of the world (attitudinal change?)

NEUROBIOLOGY OF ABUSE

- Chronic activation of certain parts of the brain involved in the fear response — hypothalamic-pituitary-adrenal-(HPA) axis

  can “wear out” other parts of the brain such as the hippocampus (memory, cognition, communication)

* HPA axis significantly influences cognitive development as well as behavioral and emotional regulation
* Abuse and addiction impact learning, behavior, and psychological and moral development on a cellular level (issue of choice?)

NEUROBIOLOGY OF ABUSE

- Neural systems that are chronically activated by threat can change in permanent ways:
  -- Altering number of synapses
  -- Changing dendritic density
  -- Inhibit development of neurons
  -- Alter neurotransmitter receptors
  -- Change gross structure and volume of the hippocampus

NEUROBIOLOGY OF ABUSE

- Chronic stress may have neurotoxic effects and lead to learning and concentration impairments secondary to the damage to the hippocampus including:

  -- accelerated loss of neurons (Smythies, 1997)

  -- delays in myelination (Dunlop, 1997)

  -- abnormalities in developmentally appropriate pruning (Todd, 1992)

  -- inhibition of neurogenesis (Tanapat, 1998)

THE EFFECTS OF ABUSE AND NEGLECT

- Diminished growth in the left hemisphere — may increase risk for depression (Teicher, 2000)
- Irritability in the limbic system can set the stage for the emergence of panic disorder and post-traumatic stress disorder (Teicher, 2000)
- Smaller growth in the hippocampus can increase the risk for dissociative disorders and memory impairment (Teicher, 2000)

ADOLESCENT BRAIN DEVELOPMENT

- To appreciate consequences of risky behavior, one has to have the ability to think through potential outcomes and understand the permanence of consequences, due to an immature prefrontal cortex, teens are not skilled at doing this
- Teens do not take information, organize it, and understand it in the same way that adults do—they have to learn how to do this

ADOLESCENT BRAIN DEVELOPMENT

- Important to understand that teens often fail to heed common sense or adult warnings because they simply may not be able to understand and/or accept reasons that seem logical and reasonable to adults
- NEVER assume that you and a teen are having the same understanding of a conversation

ADOLESCENT BRAIN DEVELOPMENT

- With experience, teens are able to temper their instinctive ‘gut’ reaction with more rational, reasoned responses—they are able to “apply the brakes” to emotional responses. During this time of development, teens need adult mentors and role-models who demonstrate how to make good decisions and how to control emotions

ADOLESCENT BRAIN DEVELOPMENT

- Adolescence involves the maturation of self-regulation of behavior and emotions—teens need to learn how to navigate complex social situations under conditions of strong emotions – such as social anxieties, romantic relationships, academic pressures, desires for immediate gratification vs. long term goals, moral dilemmas, and success/failure

IMPLICATIONS FOR PREVENTIONISTS

PROGRAMMING AND POLICY ISSUES

- Teens are not adults—Brain development is not complete
- Teens are operating from the emotional/impulsive/reward oriented part of the brain
- Communication is a complicated process
- Technology is transforming the world
- Disparities between knowing/feeling and understanding/behaving

NEUROSCIENCE OF SKILL BUILDING

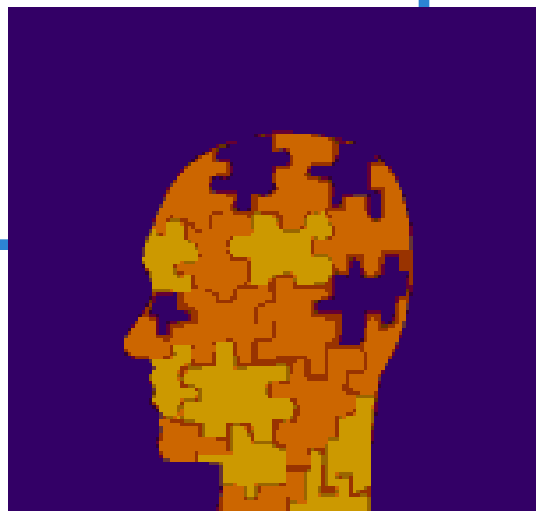
- "Skill building is a means of developing neural network integration and coordination among various neural networks" (Cozolino, 2002)
- "In order to heal a 'damaged' or altered brain, interventions must activate those portions of the brain that have been altered" (Perry, 2000c)

NEUROSCIENCE OF PREVENTION

- We have individuals who, based on life experiences, have been in effect “hard wired for negative behaviors”; therefore, preventionists must ‘re-wire these brains for positive, successful behavior’ (Shore, 1997)

LEARNING IS A PROCESS OF CREATING AND STRENGTHENING NEURAL

SYNAPSES AND CORTICAL INTEGRATION



CORTICAL INTEGRATION

- Strengthens the frontal cortex—judgment, reasoning, rational decision making, problem solving, etc
- Increases the ability of the cortex to process, inhibit, and organize reflexes, impulses, information, and emotions
- Increases ability to engage thought with affect, words with emotion, and reason with unconscious behavior (Seigal,1999)

LIMBIC REGULATION

- Limbic system plays a critical role in the regulation of emotion and memory
- “Primed” clients need to re-wire their brains by learning new skills/options
- Clients need to be in a state of “attentive calm” to learn new cognitive or behavioral skills/options
- Emotions/impulses → Logic/reason

ELEMENTS OF EFFECTIVE PREVNTION INTERACTIONS

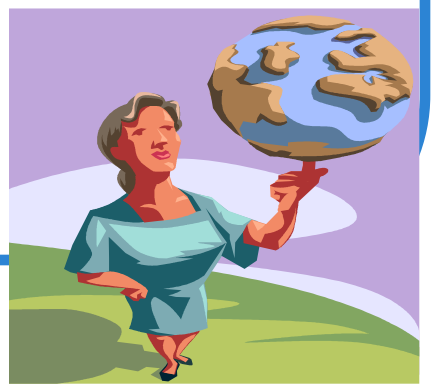
- **SAFETY** – provide understanding of persistent fear and hyper vigilance. Help client develop a state of "attentive calm". Calm client uses cortex and can engage in abstract thinking—anxious client uses limbic system and focuses on non-verbal information and survival.
- **ROLE PLAYING, MUSIC, IMMEDIATE REWARDS, AND ROLE MODELS** – provide corrective experiences, activate several areas of the brain including frontal cortex, and create new memories/options

ELEMENTS OF EFFECTIVE PREVENTION INTERACTIONS

- **CORRECTIVE THINKING** – correct false assumptions, reframe thinking—client is not bad, stupid, sick, or damaged
- **STRUCTURE** – provide a safe, predictable, consistent environment that helps to reduce anxiety
- **DISCERNMENT** – provide experiences in which clients practice "reading" facial expressions and "social" situations

ELEMENTS OF EFFECTIVE PREVENTION INTERACTIONS

- **INFORMATION** – help clients understand how their brains develop; how brain function impacts behavior; and process for re-wiring the brain
- **HOT/COLD COGNITION** – during stressful, emotional, or threatening situations "problem solving" information in the cortex is not easily accessed; clients need practice and concrete ways to access information and skills

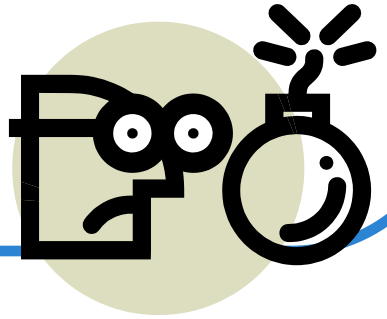


Defineing the Role of the Student Assistance Counselor

- Prevention should start at home and in the schools
- Defining at risk behavior
- Originally at risk for substance involvement
  - Included red flag behavior such as change in behavior, family history, poor grades, early involvement

Philosophical changes in SAC program

- At risk defined as at risk for academic failure.
- Prevention curriculum expansive approaches
- SAC involved with broader variety of behaviors
  - Depression, eating disorders, self injurious behavior, lack of motivation
  - Crisis intervention important role for SAC
  - Adopt new certification criteria 2006



School Resources for Intervention

- Intervention and referral services
- 504 medical modifications
- Child Study Team evaluations

PREVENTION

- To delay the onset of the use and abuse of alcohol, tobacco and drugs
- Promote healthy relationships between family, community and peers
- Strengthen protective factors and/or to reduce risk factors

Protective and Risk Factors

- Increase a child's resiliency in:
- Social skills
- Family bonds
- School attachment
- Community involvement

- Vary by age, cultural identity, psychosocial development and environment
- Lack of parental guidance
- School failure
- Experiment with drugs

Prevention Strategies

- Universal, all youth
- Selective for vulnerable youth
- Indicate youths already involved in substance use

Connecting Services

- Children feel competent when and do well in school when:
  - Students are connected and have access to community resources
  - Families seek preventions services, value education and spend time with children
  - Parents have clear expectations
  - Parents and schools have consistent message
  - School involve families to encourage positive behavior

Elements of a Good Program

- Skilled leader that student appreciate
- Students learn to recognize stress
- Develop refusal skills
- Accurate information about substances
- Include peer groups in activities
- Use interactive techniques
- Involve families and communities

SUMMARY

- It appears that aggressive, submissive, and frustration behaviors may be genetically encoded. If relationships are negative, threatening, and/or fear inducing, the lower brain responses become dominant and the cognitive regulating structures do not develop to their full capacity; consequently, an individual may not develop the cognitive ability to control emotions or behavior.

SUMMARY

- Prevention specialists need to educate themselves and their clients about neurobiology of abuse and addiction as well as brain development
- Interventions must activate those portions of the brain that have been altered or underdeveloped
- Positive therapeutic experiences can contribute to healing and growth